

THE BARENTS SEA MARINE ENVIRONMENT AIR-SPACE MONITORING IN HYDROCARBON RAW MATERIALS EXTRACTION AND ITS TRANSPORTATION

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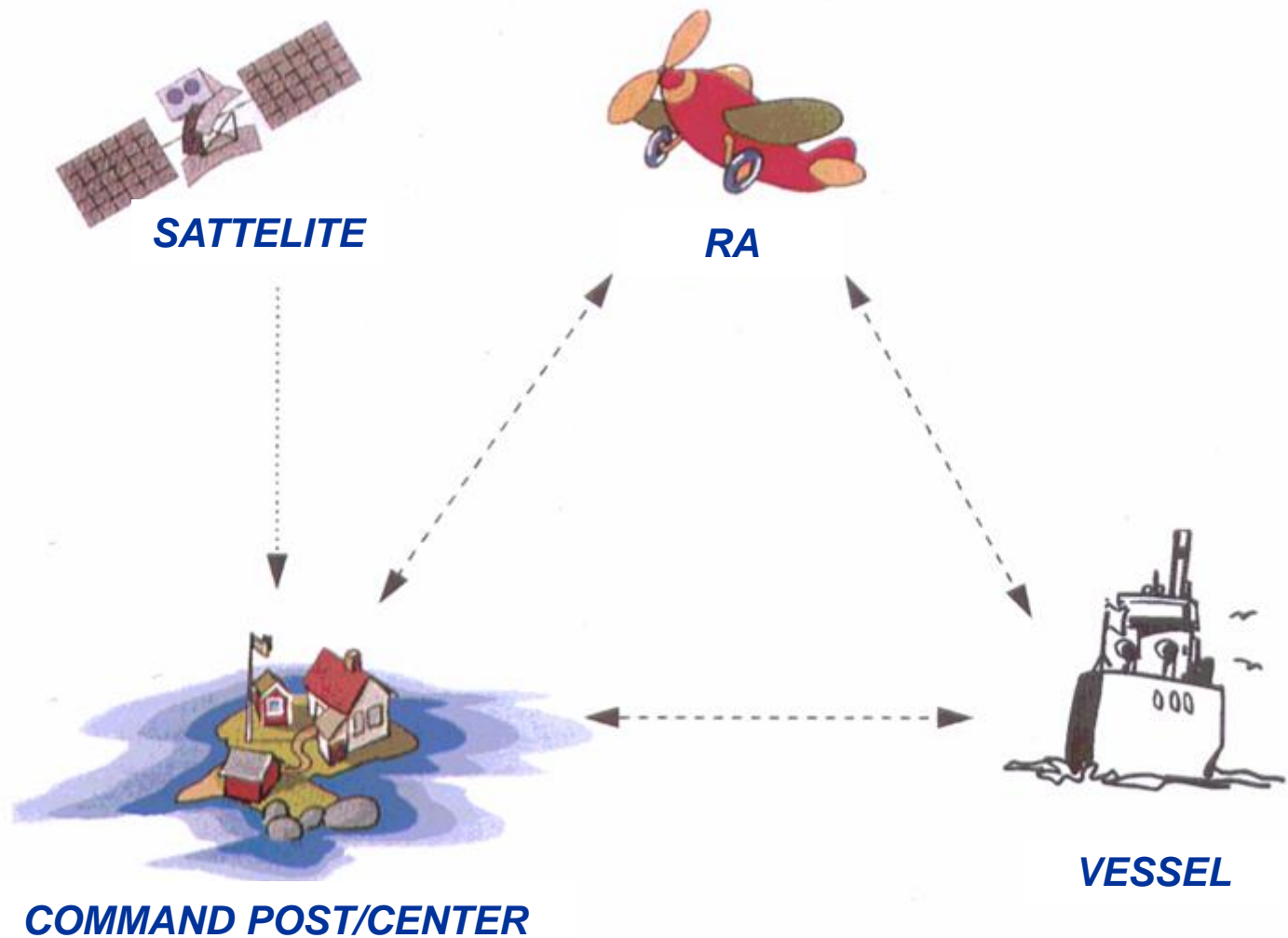
MARINE ENVIRONMENT AIR-SPACE MONITORING IN HYDROCARBON RAW MATERIALS EXTRACTION AND ITS PRODUCTS TRANSPORTATION PRINCIPAL ELEMENTS

1. SATELLITE MONITORING - EVERY DAY IS CARRIED OUT:

- space apparatuses which radar systems are equipped. It allow to detect and record any type of organic pollutions independent on atmospheric phenomenon (so-named all weather detection and recording). At present this task with using satellites ERS-2, RADARSAT, ENVISAT can be solved, for example;***
- space apparatuses which multispectral systems with high and very high spatial systems are equipped. At present many different satellite types flight in space. Here has a considerable limitation which has a principle and decisive significance for the Barents Sea, it is considerable dependence on illumination (time of day) and weather conditions, including atmospheric phenomenon.***

2. AERIAL MONITORING - IN DETECTION AND RECORDING OF OIL SPILL AND ANY OTHER ACCIDENT SITUATION WHICH WERE EXPOSED ON BASE OF SATELLITE MONITORING IS CARRIED OUT:

- this activity efficiently is fulfilled and it principal task are exact definition of sources and accident scales including oil spill sizes and volume of work for accident liquidation. For this purposes special equipped research aircraft (RA) would be used.***



SCHEME FOR MARINE ECOLOGICAL MONITORING, POLLUTION CONTROL AND ACCIDENT OIL SPILLES OPTIMUM ENSURING



POSSIBILITIES FOR OIL SPILLS AND FILMS DETECTION AND RECORDING FROM SATELLITES

- * ERS - 2:** *Enough good for oil films and spills detection and recording;*
- * RADARSAT:** *Acceptable for oil films and spills detection and recording in use of narrow directed range;*
- * ENVISAT:** *Good in using of ASAR wide swath for oil spills and films monitoring.*



SATELLITE SYNTHETIC APERTURE RADAR (SAR) PRINCIPAL MERITS IN COMPARISON WITH OTHER REMOTE SENSING EQUIPMENTS

- * Good possibility to get SAR images in any time of day independent on illumination;*
- * Absolute independent on clouds cover and any atmospheric phenomena (all weather possibilities);*
- * Good possibility to detect and record the oil slicks, spills and films as well as vessels*

SATELLITE SAR PRINCIPAL TECHNICAL SPECIFICATIONS

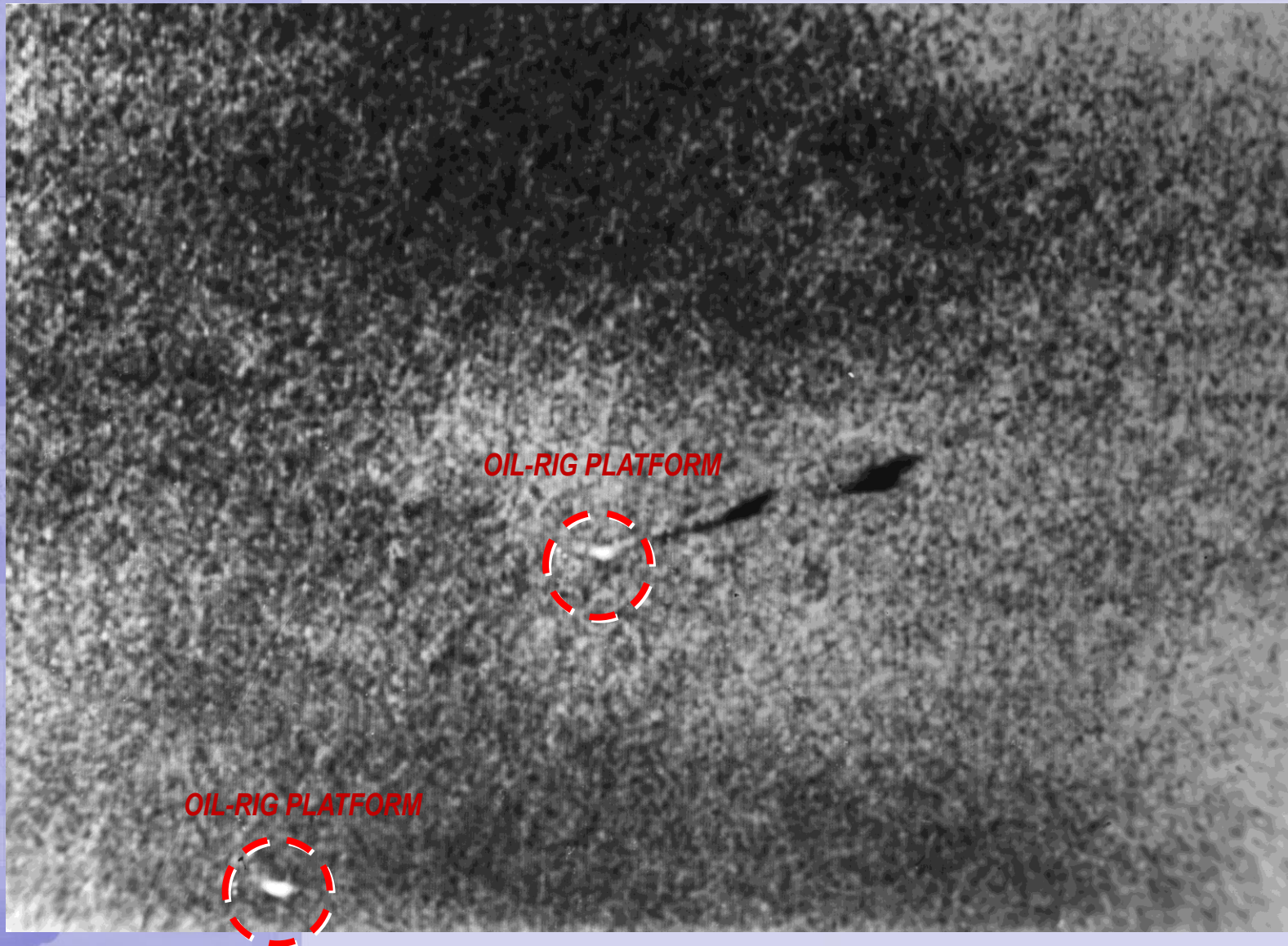
SATELLITE	RADIATION WAVELENGTH (CM)	POLARIZATION	SWATH (KM)
<i>ERS - 2</i>	5.7	VV	100
<i>RADARSAT</i>	5.7	HH	50-500
<i>ENVISAT</i>	5.7	VV/HH	50-410

SAR POSSIBILITIES OF OIL SPILLS AND FILMS DETECTION FOR DIFFERENCE WIND SPEED

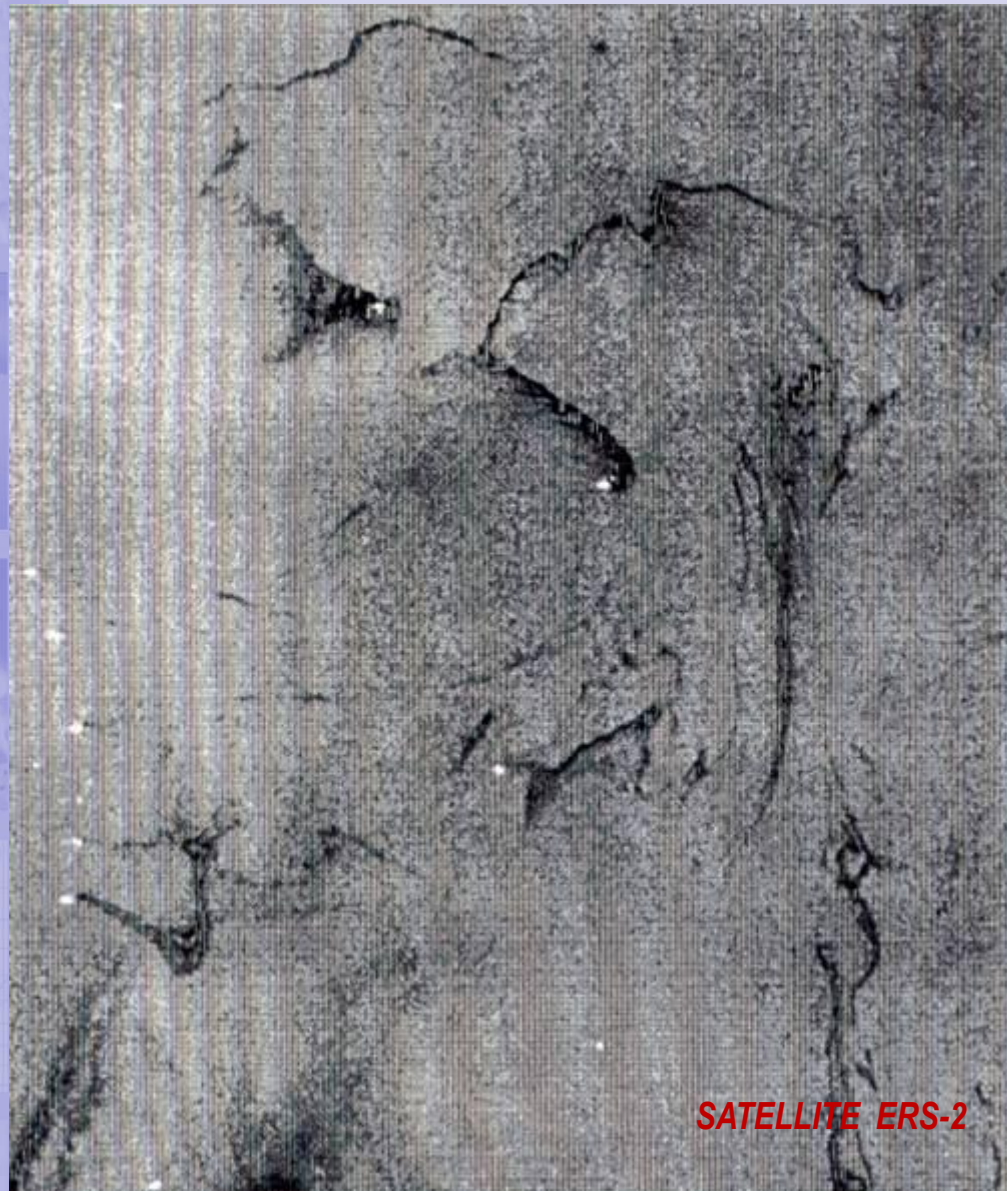
- * 0 m/s (no sea surface waves) – return radiation from non rough of sea surface is absented, this case any oil spills and films in SAR images can not display;*
- * 3 m/s - very good conditions for roughness on sea surface making during absolutely absence of wind influence to oil spills and films, i.e. this case has very high possibility for its detection and recording;*
- * from 3 m/s to 7-10 m/s - some better conditions than in wind is absented for oil films and spills detection and recording;*
- * > 7-10 m/s - it is a heavy wind which quickly wreck oil spills and films, thick oil films and spills only possibly detection and recording.*

PRINCIPAL LIMITATIONS IN SATELLITE SAR USING

- * *Oil is not always only phenomenon on sea surface which can form SAR image like oil spills and films;*
- * *Existing possibilities of SAR images earth surface (including sea surface) covering not always can guarantee of oil spills and films opportune detection and recording;*
- * *SAR images don't allow to determine efficiently oil platforms and vessels correct positions (coordinates) but its provide their detection and recording reliably.*



EXAMPLE OF ERS-2 SAR IMAGE FOR TWO OIL-RIG PLATFORMS WITH OIL SPILL AND WITHOUT IT (CLEAR SEA SURFACE)



EXAMPLE OF OIL SPILLS AND FILMS ERS-2 SAR IMAGE CLOSELY OIL-RIG PLATFORMS

PRINCIPAL MERITS OF AERIAL MONITORING USING FOR OIL POLLUTIONS DETECTION AND RECORDING

- * Vast area of search and possibilities for detection and recording of marine pollutions in short time;*
- * Possibility of direct measuring and analyze for pollution size and type;*
- * Possibility of pollution sources reliable identification;*
- * Possibility of observation data and results correct documentation;*
- * Possibility of quick vessel inform for efficient pollution liquidation.*

PRINCIPAL AIRBORNE REMOTE SENSING EQUIPMENT AND TASKS WHICH SOLVE BY THEY IN OIL POLLUTION AERIAL MONITORING

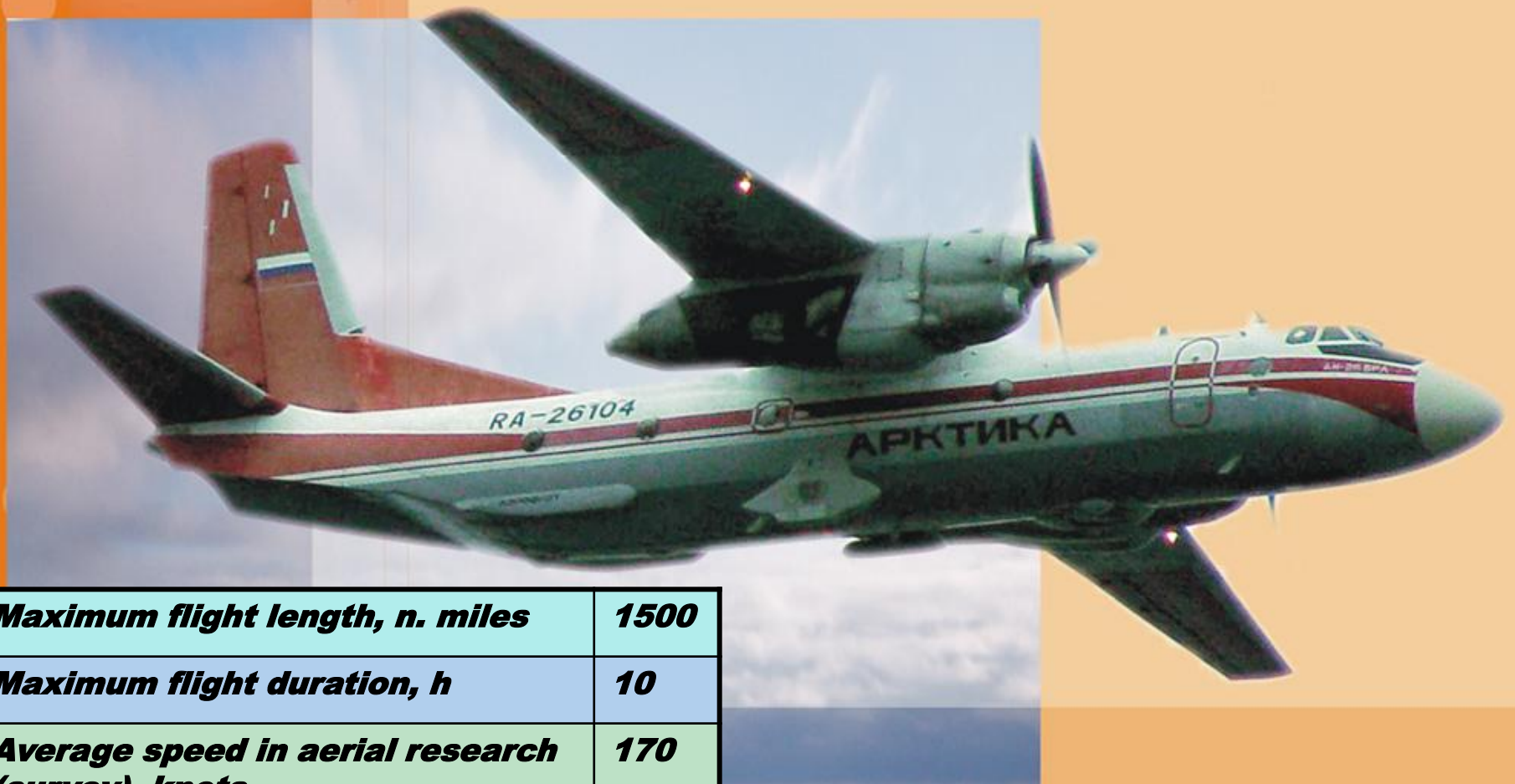
- * **Synthetic aperture radar (SAR)** – oil pollution (spills, films, patches and so-on) search, detection and recording in vast sea areas;
- * **Infrared (IR)/Ultraviolet (UV) liner scanner** – information about thin oil films;
- * **Microwave radiometer (MWR)** – oil spills size measuring;
- * **Fluorescent LIDAR (FLIDAR)** – thin oil spills and films recording, their analyze and chemical composition definition;
- * **Video- and photo cameras** – identification of pollution sources and their documentation;
- * **Means of print** – preparing of documents;
- * **Means of connection** – efficient of vessels and coastal center (command post) inform including exchange of information.

AIRBORNE REMOTE SENSING EQUIPMENT COMMON SPECIFICATION

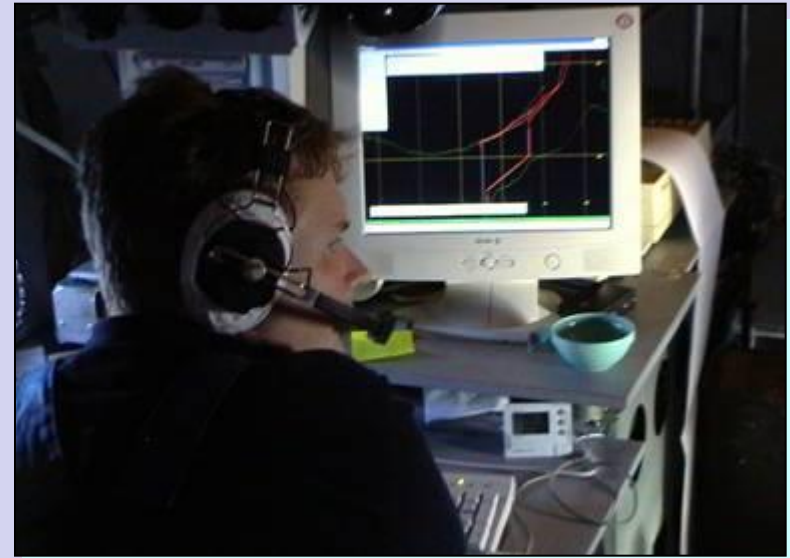
Means of measuring/observations	Level of development	Experience of using	Opportunity of using for oil detection	Opportunity of using for false objects detection
<i>Visual</i>	<i>high</i>	<i>high</i>	<i>insufficient</i>	<i>low</i>
<i>Video-cameras</i>	<i>high</i>	<i>high</i>	<i>insufficient</i>	<i>low</i>
<i>Photo-cameras</i>	<i>high</i>	<i>high</i>	<i>insufficient</i>	<i>low</i>
<i>IR-cameras (3-5 mkm)</i>	<i>high</i>	<i>middle</i>	<i>insufficient</i>	<i>low</i>
<i>IR-cameras (8-14 mkm)</i>	<i>middle</i>	<i>middle</i>	<i>middle</i>	<i>middle</i>
<i>UV-cameras</i>	<i>middle</i>	<i>middle</i>	<i>insufficient</i>	<i>low</i>
<i>IR/UV-scanners</i>	<i>middle</i>	<i>middle</i>	<i>middle</i>	<i>middle</i>
<i>Multispectral scanner (MSS)</i>	<i>middle</i>	<i>middle</i>	<i>insufficient</i>	<i>low</i>
<i>FLIDAR</i>	<i>middle</i>	<i>low</i>	<i>good</i>	<i>good</i>
<i>SAR/SLAR</i>	<i>high</i>	<i>high</i>	<i>middle</i>	<i>low</i>
<i>MWR</i>	<i>middle</i>	<i>middle</i>	<i>middle</i>	<i>middle</i>

Possibilities of Airborne Remote Sensing Equipment Using for Difference Purposes in Oil Pollution Monitoring									
Means of measuring/observation	Tactical supporting	Recording of vessel throwing	Cause of throwing	Spills mapping	Sensitivity to weather conditions and time of day	Oil pollution recording close to coast	Oil dust recording	Ordinary possibilities	Sum of numbers
Visual	2	2	1	2	0	1	1	2	11
Video-cameras	2	2	1	2	0	2	1	2	12
Photo-cameras	1	3	3	2	0	1	0	1	11
IR-cameras (3-5 mkm)	2	2	2	3	2	0	1	2	14
IR-cameras (8-14 mkm)	4	3	3	3	2	0	1	3	19
UV-cameras	2	2	1	3	0	0	0	2	10
IR/UV-scanner	4	3	3	4	2	0	1	4	21
MSS	1	1	1	2	0	1	0	1	7
FLIDAR	4	5	5	1	3	5	5	4	32
SAR/SLAR	0	3	2	4	4	0	0	4	17
MWR	1	2	1	2	3	0	0	1	10
0- absolutely did not apply	1-very low	2-limited	3-middle	4-good	5-perfect				

SPECIALLY EQUIPPED AIRCRAFT (RESEARCH AIRCRAFT)
ANTONOV-26 (AN-26) NAMED “ARKTIKA”
(IN ENGLISH “ARCTIC”)

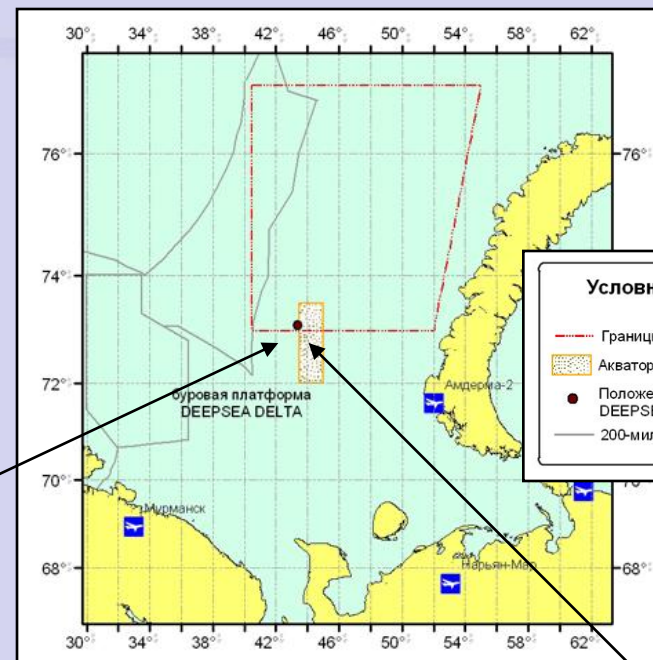


<i>Maximum flight length, n. miles</i>	<i>1500</i>
<i>Maximum flight duration, h</i>	<i>10</i>
<i>Average speed in aerial research (survey), knots</i>	<i>170</i>
<i>Maximum take-off mass, tons</i>	<i>25</i>



**WORKING FRAGMENT EXAMPLE ONBOARD RESEARCH AIRCRAFT
“ARKTIKA”**

CLOSELY OIL-RIG PLATFORM DEEPSEA DELTA IN AREA OF THE SHTOKMAN GAS-CONDENSATE DEPOSIT (SGCD)





OIL-RIG PLATFORM



FLYING AROUND OF OIL-RIG IN THE PECHORA SEA



**EXAMPLE OF
SEA SURFACE
POLLUTION
AFTER SHORT
TIME FUEL
THROWING**



**EXAMPLE OF OIL SPILLS ON SEA SURFACE CLOSELY
COASTAL LINE**



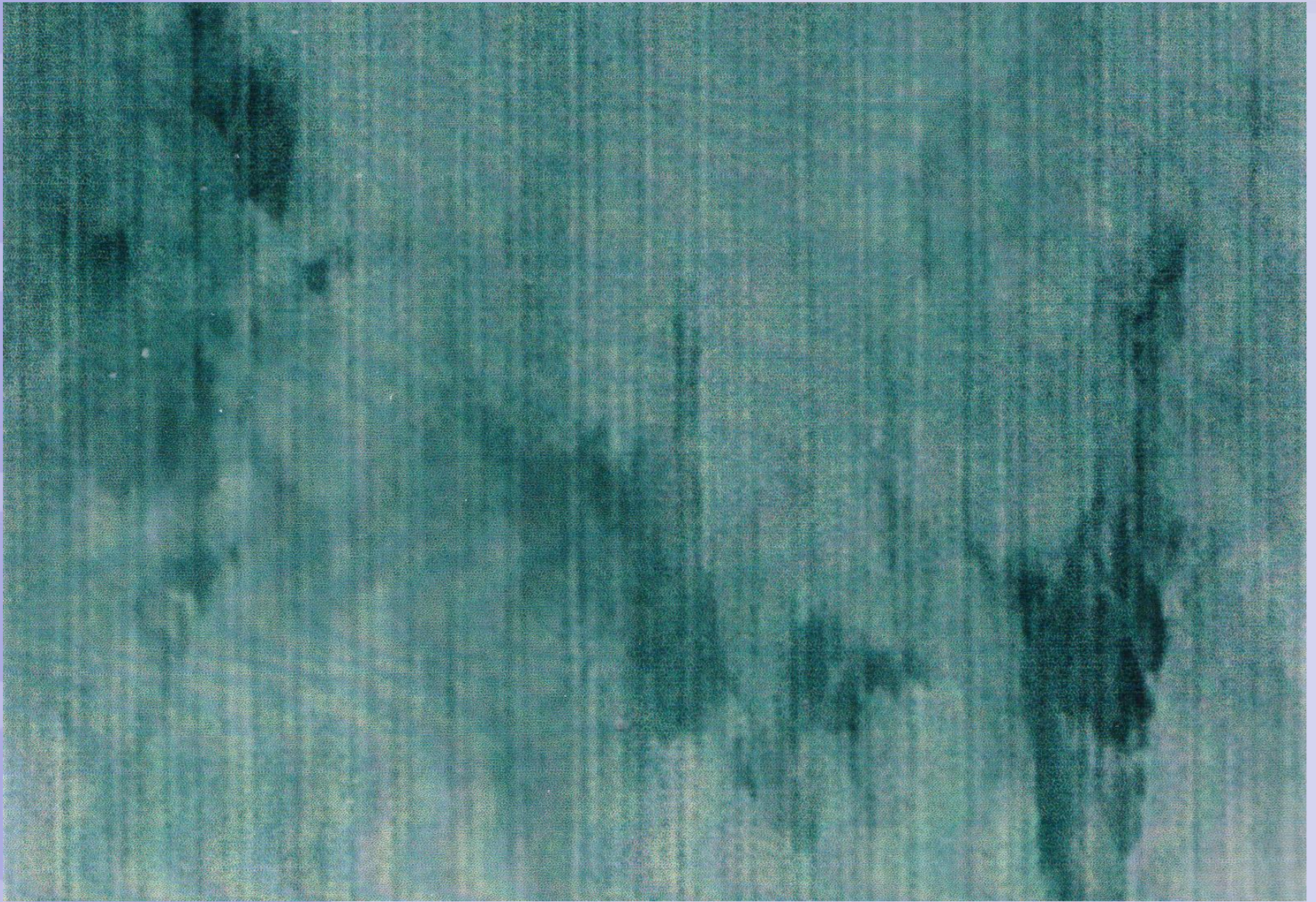
EXAMPLE OF OIL WASTE PRODUCTIONS CLOSELY VARANDEY



EXAMPLE OF INDUSTRIAL POLLUTION ON SHORE CLOSELY VARANDEY

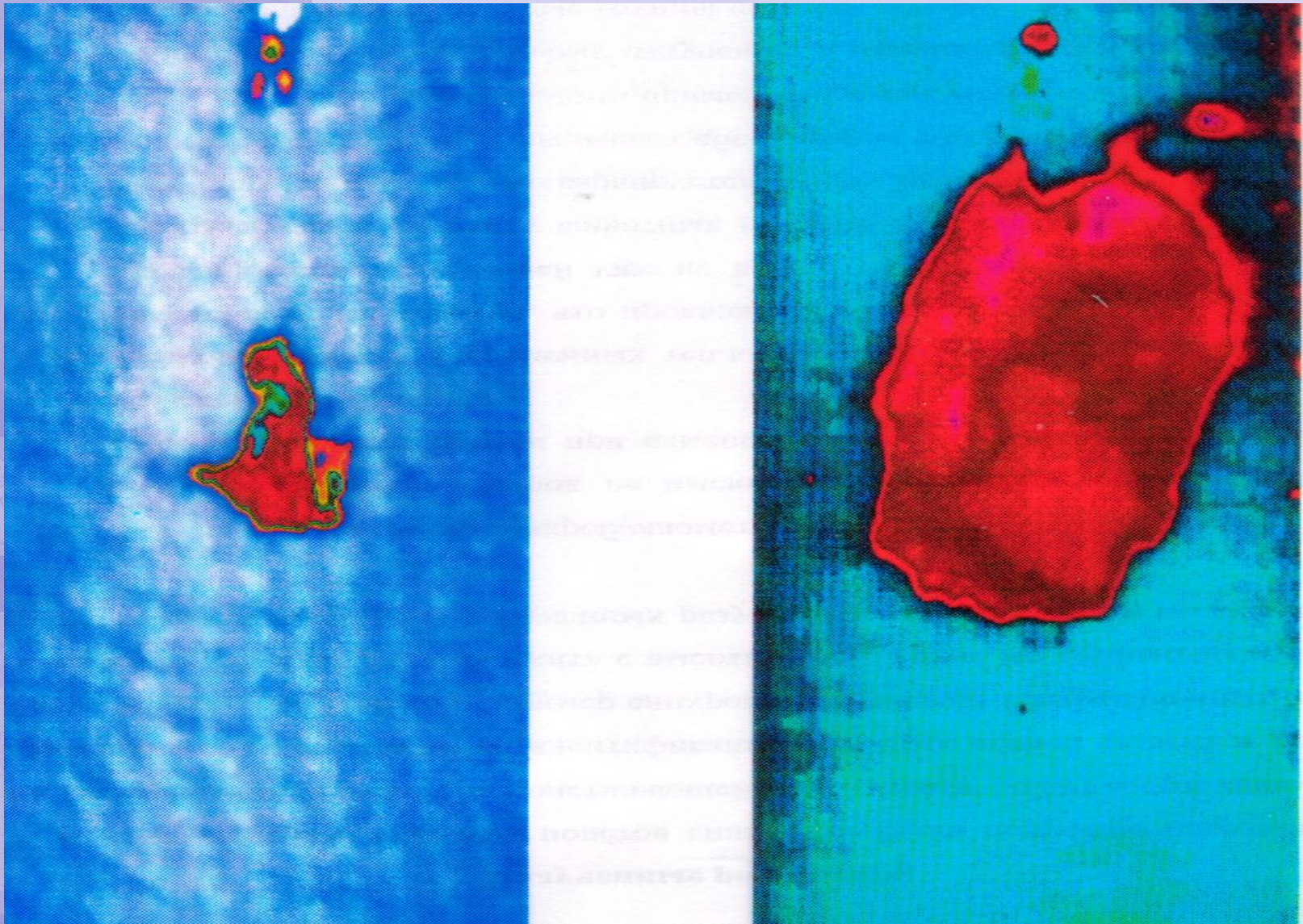


IR IMAGE EXAMPLE OF VESSEL WHICH THROWS FUEL SHORT TIME

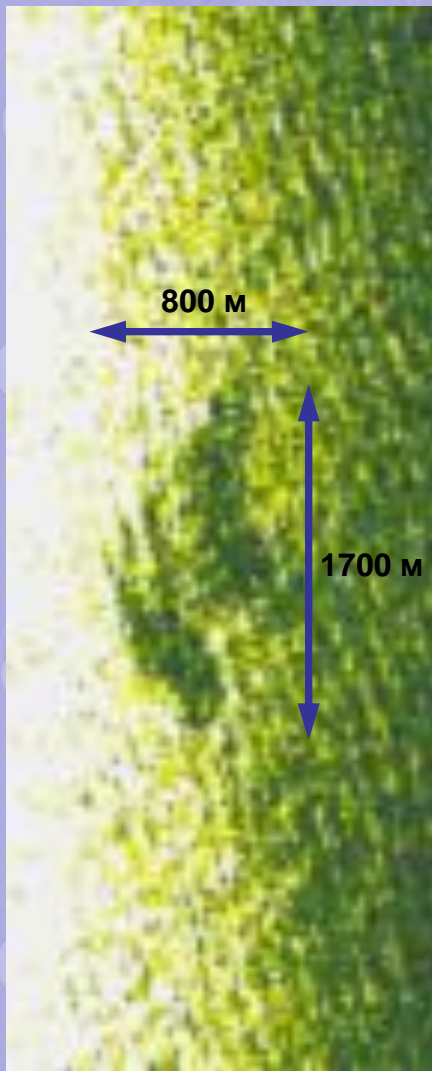


IR IMAGE EXAMPLE OF OIL SPILLS ON SEA SURFACE

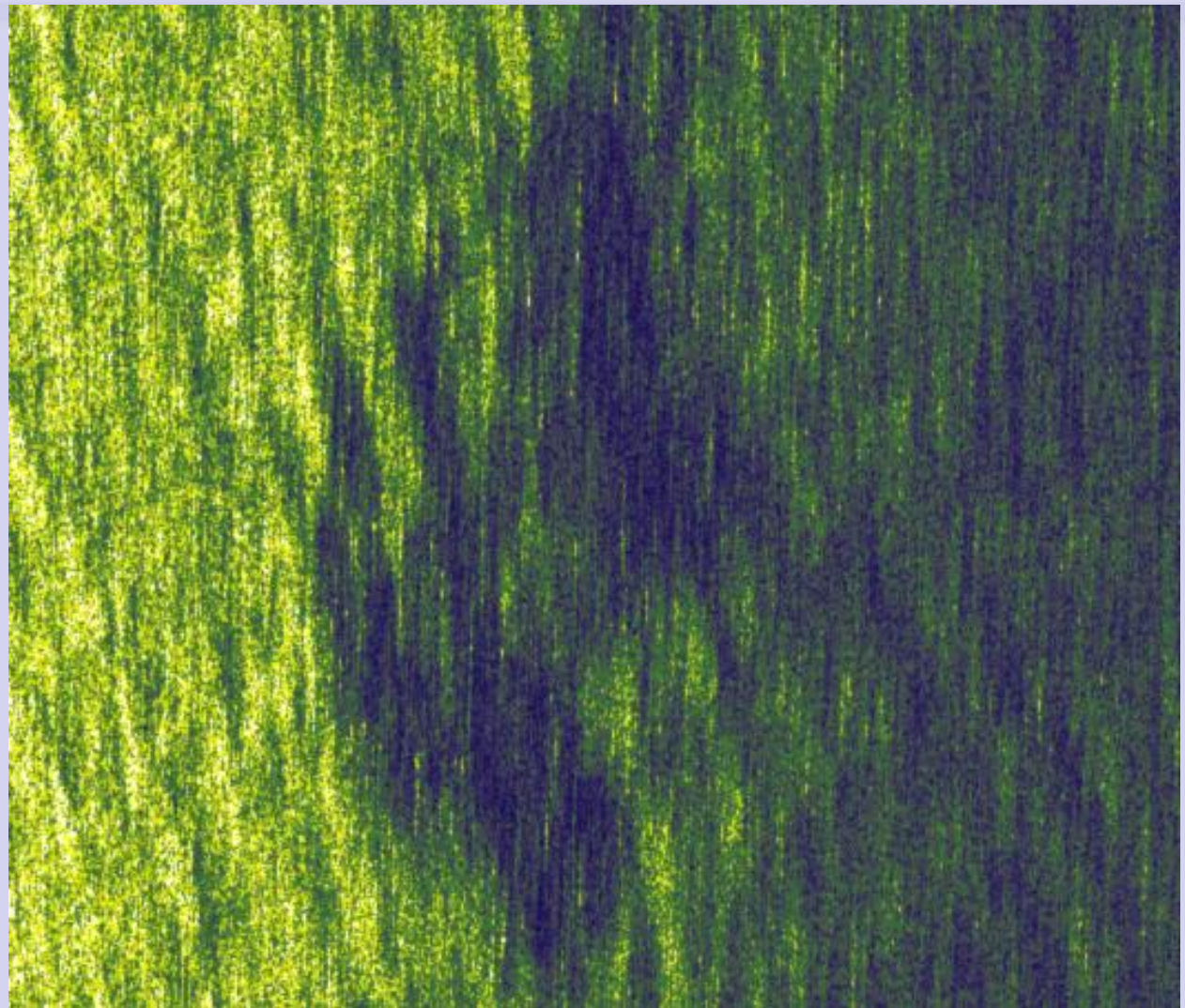




MICROWAVE IMAGE (LEFT) EXAMPLE OF OIL FILM BY THICKNESS ABOUT 2.5 MM AND LINE SIZE ABOUT 130 M X 75 M, FROM RIGHT SIDE IS EXAMPLE OF UV IMAGE



***EXAMPLE OF LOW
SPATIAL RESOLUTION
IMAGE***



EXAMPLE OF HIGH SPATIAL RESOLUTION IMAGE

OIL SPILL SAR IMAGE EXAMPLE FROM RESEARCH AIRCRAFT “ARKTIKA”

MAIN CONCLUSIONS

PRINCIPAL MERIT ABOVE APPROACH IS POSSIBILITY OF VAST SEA SURFACE AREA REGULAR MONITORING IN MINIMUM FINANSIAL EXPENSES BUT WITH HIGH LEVEL OF RELIABILITY, EFFECTIVNESS, AND QUALITY;

AS SHOW MANY EXPERTS INDEPENDENT ECONOMICAL CALCULATIONS FOR LIQUIDATION EVEN INSIGNIFICANT ACCIDENT SITUATION TOTAL EXPENSES FOR THAT WILL BE IN 3-6 TIMES MORE IN COMPARISON WITH ENSURING OF EVERY YEAR AIR-SPACE MONITORING IF WILL BE CREATED AND FUNCTION SPECIAL REGIONAL SERVICE UNDER ABOVE APPROACH.



THANKS A LOT FOR YOUR ATTENTION!